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Fermi Questions, Question 1: Penny Floors; Question 2: Secondhand Smoke

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Table I. Period of inertial balance with smartphone and masses.

Mass (kg)	*Period (s)*
0.097	0.17±0.01
0.228	0.25±0.02
0.328	0.29±0.02
0.428	0.34±0.02
0.528	0.38±0.01
0.628	0.42±0.01
0.728	0.45±0.02

alone, all the five masses of 0.100 kg together with the smartphone, are shown in Table I.

A graph of these values with its logarithmic linearization is shown in Fig. 6; the fit was verified in the logarithmic graph, shown to the right. The power of the mass was found to be 0.498 ± 0.012, which is approximately a square root. This result is typical of spring-mass systems.

With these simple results, it has been demonstrated that an accelerometer-equipped smartphone can be a very useful tool to determine the inertial mass of an object, with or without gravitational pull present. The smartphone, throughout the many references now published in various journals and presented in conferences, has established itself as a versatile tool for teaching and learning introductory physics.

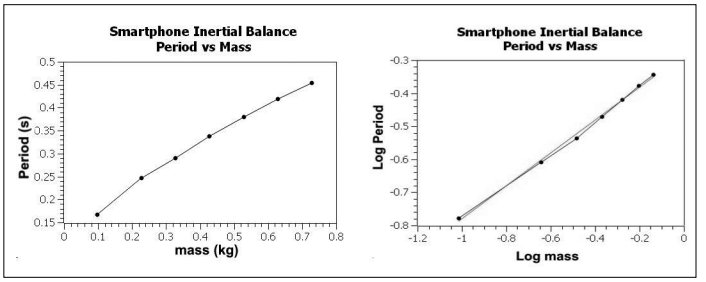

Fig. 6. Period as a function of mass for the inertial balance as measured with the smartphone.

References

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Fermi Questions

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Question 1: Penny floors

How many pennies does it take to tile the floor of a room? How much does that cost? (*Thanks to Delaney Wright, Olivia Reel, and Halina Garraway of my Oklahoma Scholar-Leadership Enrichment Program (OSLEP) class for suggesting the question.*)

Question 2: Secondhand smoke

How dangerous is secondhand smoke? (*Thanks to Olivia Reel from my Oklahoma Scholar-Leadership Enrichment Program (OSLEP) class for suggesting the question.*)

Look for the answers next month online at *tpt.aapt.org*. Question suggestions are always welcome! For more Fermi questions and answers, see *Guesstimation 2.0: Solving Today's Problems on the Back of a Napkin,* by Lawrence Weinstein (Princeton University Press, 2012).

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